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THE AGRICULTURAL EXPERIMENT STATION AND THE STATE

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THE AGRICULTURAL EXPERIMENT STATION AND THE STATE

By

FRED RASMUSSEN, Secretary of Agriculture.

RELATION OF AGRICULTURAL PRODUCTION TO POPULATION.

Each succeeding census has shown a steady increase in population and in industrial and agricultural activities of Pennsylvania. The output from the factories and mines has passed from being counted in millions, to being counted in billions of dollars! The total value of the agricultural products of the State has greatly increased. Unfortunately an increase in the total value of the agricultural output of the State does not mean increased production or increased profits to the farmer, for the increased value may be due to an increase in price per unit, and the increase in the price per unit may be absorbed by the increased cost of production and of living. A comparison of the agricultural output, which should be of interest to every man and woman of the State, is the ratio of the agricultural production of the State to the total number of people to be fed and sheltered.

The population of Pennsylvania was 1, 724,033 in 1840. In 1880 it was 4,282,891, and in 1920 it was 8,720,017. Think of it! An increase of 4.437,126 in 40 years, or more than double. This is an average increase of 1,109,281 each decade. In 1880 the acreage of wheat was 1,445,384 with a production of 19,462,405 bushels, compared with 1,429,589 acres and a production of 23,567,242 bushels in 1920. In 1880 the State produced 4.5 bushels of wheat per person, while in 1920 only 2.7 bushels! In 1880 the acreage of potatoes was 183,079, with a production of 16,284,819 bushels, compared with 233,981 acres, with a yield of 22,051,685 bushels, in 1920. The State in 1880 produced 3.8 bushels of potatoes per person, while in 1920, in spite of an increase in acreage and yield, it only produced 2.5 bushels per person. In 1880 there was in this State 1 head of cattle to 2.2 persons. In 1920 this ratio was 1 head of cattle to 5.5 persons. In 1880 there was in this State 1 hog for every 3.5 persons, while in 1920 one hog for every 7 persons. In 1880 the sheep numbered 1 for every 2.3 persons, while in 1920 one sheep to every 16.3 persons. Many more figures might be given, but these are sufficient to illustrate that food production in Pennsylvania is not increasing as rapidly as is the increase in population, and that this State more and more is coming to depend upon areas outside its confines for a large supply of the food stuffs of the people.

AGRICULTURAL AND FORESTRY LAND AND WATER POWER.

The first permanent settlement in Pennsylvania was made by William Penn in 1682, only 239 years ago. Pennsylvania, although one of the oldest states in the Union, is a very young Commonwealth. The life of man is measured by three score years and ten. The life of a nation cannot be measured in years. Pennsylvania, therefore, must be looked upon as immortal. In the short span of 40 years the population of Pennsylvania increased 4,437,126, and it is to be expected it will continue to increase and add other millions of people during the next 40 years—all these must be given employment and must be fed! This being the case there is no greater economic problem before the State than the development and conservation of its natural resources. Pennsylvania is blessed with an abundance of natural resources. However, the forests are already depleted, and in time the oil, the coal and the minerals will cease to be abundant, but the one great natural resource of the State—the productive power of the farm and forest land, if properly managed, cannot be exhausted.

The Agriculture of Pennsylvania, both in itself and in relation to other activities, is in the final analysis the most important industry of the State. Approximately eleven million acres of land not suited for agricultural purposes but adapted for forestry have, if properly developed, protected and managed, a productive power and importance in the future development of the industries in the State far beyond the understanding and appreciation of the great majority of its citizens. When looking into the future, the agricultural and the forest lands and the water power of the State constitute the three greatest permanent economic assets of the State, because, compared with other natural resources, through proper use and management they are inexhaustible. The fact that the fertility of the soil cannot only be maintained, but, when the conditions and needs of the soil are understood, it can be made to produce human food in increasing amounts, is the thing which inspires individuals and governments to take up research and experimentation in agriculture, and which makes it possible to look into the future as regards the permanency of the human race, for unless adequate vegetation is maintained the people will perish from the earth.

FOOD, LUMBER AND INDUSTRY.

Pennsylvania ranks second in industry, and seventh in total value of its agricultural products, of all the States in the Union. There is produced in the State a large surplus of manufactured and mined products which, of course, more than offsets the food and other products which the State buys, and little attention therefore has been given to the ever-increasing amount of food products which it is necessary to bring into the State. The maintenance of industry primarily depends upon access to raw materials, and a sufficient and comparatively cheap food supply, and housing facilities for the worker. Sections of the East, especially New England, are today struggling to maintain some of their important industries. Increased cost of transportation and coal, and a shortage of locally produced food stuffs, are great handicaps to competition with sections more favorably located in this respect. Massachusetts in 1920 dropped from fourth to fifth place in total value of manufactured products, being supplanted in rank by Ohio. Pennsylvania is blessed with an abundance of raw material for manufacture, both coal and minerals, but is limited in its food and lumber supply. It is important to know that two of the main limiting factors to the progressive commercial and industrial life of the State are food and lumber, but it is of still greater importance to know and understand that it is within the power of the people of the State to a very large extent to overcome this handicap, for there are great opportunities for increasing both the food and lumber supply in Pennsylvania, at a cost a great deal less than its value.

AGRICULTURE IS OF PUBLIC CONCERN.

The first significant step by the people in recognizing a public interest in agriculture, was the Morrill Act passed by Congress in 1862, the provisions of which have been accepted by all the States, providing for the establishing of Land Grant Colleges for the teaching of agriculture and mechanic arts. Following this was the Hatch Act, passed in 1887, appropriating $15,000 annually, to each State, for experimental work in agriculture, and the Adams Act, passed in 1906, appropriating $15,000 for research work in agriculture. Both of these Acts direct Federal appropriations to the States without specific obligation on the part of the State when accepted. In 1914, the Smith-Lever Act was passed by Congress making an appropriation for Extension work in agriculture, making it obligatory that the States appropriate an equal amount to receive the Federal appropriation. Finally the Smith-Hughes Act of 1917 was passed, making appropriation by Congress for vocational training, also making it obligatory on the part of the State to match the appropriation dollar for dollar. Each of these Acts shows a decided public interest in agriculture. They also imply that progress in agriculture is based upon three distinct functions: (1) the teaching to young men in the colleges, the sciences and their relation to agriculture, and the fundamental principles and practices underlying farm operation, so as to advance the science of agriculture in research, in teaching, and in practice; (2) research and experimental work. Research establishes new principles and truths, and, through experimental work, suspected or known truths are demonstrated; (3) the Extension Service, which brings to the farmer the results from the research laboratory and the experimental work, in order that scientific principles may be applied to agricultural practices. Teaching in the College and in the school, research and experimentation, and the extension of information to the farmer, are all important factors in agricultural progress. Without making any comparison as to which of these is the most important, it is easy to see that research and experimentation is the basis for teaching in the College, the school, and on the farm, and that neither the teaching nor the extension service in the State, can reach its maximum efficiency unless research and experimental data are obtained to be applied locally. In this State the facilities for, and the amount of research and experimental work under way are far from meeting the many pressing inquiries which come from the teaching and extension forces, and the farmer, and it is safe to say that a point has been reached where a lack of definite knowledge on innumerable questions is a most serious limitation to the agricultural progress of the State.

SOILS AND CLIMATE.

Some of the natural factors which determine the character of agriculture in a community are the character of the soil, the climate as determined by location and altitude, nearness to centers of population, and marketing facilities. Pennsylvania has a variety of different soils. Along the northern tier of counties, and southward along the western border of the State, are found the Volusial series, a soil of glacial formation. In the southwestern portion of the State is found what is called the Westmoreland soil, intermingled in places with small areas of pure limestone of the Brooks formation. Through the central part of the State, and covering more than 40 per cent. of the soil area, is found the DeKalb series. Scattered through the mountains and in the wide valleys east of the Blue Ridge is the Hagerstown loam. In scattered areas in the State is found the Berks shale, and in the extreme southeastern corner of the State are the Chester soils. Not only are there a large number of different soil series in the State, but in many instances, there is as great a difference in types within the series as there is difference between the various series. The location of the State, stretching 150 miles from north to south and being crossed by a number of mountain chains running diagonally southwest to northeast, gives rise to quite varied climatic conditions within comparatively short distances. The great variations in the character of the soil, in the climate and the length of the growing season, make possible a great variety of crops, each crop with its many problems, from selecting of varieties, fertilization, cultivation, disease control, to utilization and marketing. In addition to the problems surrounding each crop, whether it be cereals, fruits or vegetables, there are the problems of the most efficient combination of crops and livestock, giving rise to a variety of farming systems with many economic possibilities.

It is not always safe to make assertions. Nevertheless, I will make the assertion, that there is no section of equal area in the United States which has as varied an agriculture, and as large a population, and which has more problems pressing for solution, than are found in traveling from Greene county north through Washington, Allegheny, Mercer, Lawrence, Crawford and Erie. In Greene county is found one of the best natural bluegrass sections in the United States, identical with the famous bluegrass area of Kentucky, with a rolling topography making the county a great sheep and cattle county. Washington county, to the north, has a topography less rolling, and has better transportation and marketing facilities. In addition to the splendid bluegrass pastures for sheep and dairy cattle, large areas are in crops and fruit. In Allegheny county, nearness to Pittsburgh tends to develop dairying, and fruit and market gardening. In Allegheny, Greene, and Washington counties, the Westmoreland soils predominate. Going north through Mercer, Crawford and Erie, the Volusia soils predominate. General farming prevails in this section, with dairying predominating. Large areas in these counties, especially in Crawford, need under drainage and heavy applications of lime before crops can be grown profitably. On the terrace formation along Lake Erie, is found a section admirably adapted to grapes and many kinds of fruit. Butler county, which joins on to the western tier of counties in the State, has large areas of the DeKalb soil. In this country is reflected the effect of the oil industry on agriculture. During the oil boom many farms were abandoned and left to grow up in weeds, and many of them have not yet been reclaimed.

The detailed description of the variation in the character of agriculture in the western part of the State, does not mean that there are no great differences in other places, in fact many other similar examples could be given. Traveling westward, for example, from the eastern part of the State, the elevation from a few feet above sea level rises through various ups and downs until reaching the top of the Allegheny Mountains, where crops are produced at an elevation of 2800 feet. This great variety of conditions gives rise to innumerable problems in soil management, soil fertility, selection and adaptation of crops, livestock problems in the economic production of cattle, hogs, sheep and poultry, problems in market gardening and fruit growing both as to the variety, cultural methods and disease control.

INCREASED FOOD PRODUCTION.

Increased food production comes either through placing new areas under cultivation, or increasing the production of crops and livestock products on the areas now under cultivation. Both methods offer opportunities. Comparing the acreage of the principal crops in 1880, with the acreage in 1920, it is found that there is a decrease in the acreage of oats of 65,947 acres, in wheat a decrease of 15,795 acres, in corn a decrease of 41,585 acres, in rye a decrease of 136-476 acres, in buckwheat a decrease of 3,455 acres, and a decrease in barley of 9,807 acres. During the same period, there was an increase in the acreage of potatoes of 50,902 and an increase in the acreage of tobacco of 15,233. During the period from 1890 to 1920, there was also a decrease of 2,109,106 apple trees.

Comparing the area of improved land, the census for 1920 shows a decrease of 1,570,810 acres over 1880, or a decrease of 11.5 per cent. In comparing the yields per acre in 1880, with the 10 year average yield from 1910 to 1920 it is found that the yield of wheat per acre increased from 13.5 to 16.4; corn from 33.7 to 40.7; rye from 9.2 to 16.9; oats from 27.3 to 33.6; buckwheat from 14.6 to 19.6; barley from 18.6 to 26.6; potatoes from 89 to 93.9. The acreage figures of the different crops show, not only a decrease in total acreage of improved land, but the figures also show little change in the relative proportion of the different crops. In other words, the character of the agriculture of the State for forty years has remained the same with a very few exceptions. An increase of 4.1 bushels of wheat, of 7.3 bushels of corn, of 6.3 bushels of oats, of 4.9 bushels of potatoes per acre in 40 years is a very slow progress. Although there is a possibility of a considerable increase in the acreage of the improved land area of the State, the great problem for the present is a better utilization of the land already under cultivation. The Pennsylvania Experiment Station at State College has done excellent work as far as its facilities permitted, and has without a doubt been of great economic benefit to the people of the State. To give just a few examples: Through careful selection and plant breeding, has been produced the now famous

Pennsylvania 44 Wheat which for seven years averaged 3.5 bushels to the acre more than the next best of the varieties in the experiment. During 1919 and 1920, twenty comparative tests were made by farmers in which the Pennsylvania 44 Wheat produced 5.64 bushels more to the acre than other varieties under similar conditions. As stated above, the increase in yield per acre over a period of 40 years from 1880 to 1920, was 4.1 bushels for the entire acreage in the State. A research man came along, who, by selection, a knowledge of plant breeding, and plant growth, makes possible an increase in yield of 5.64 bushels per acre, not in forty years, but in one year. An average increase of 5.64 bushels on the 1920 wheat acreage of the State, at $1.25 a bushel, would increase the value of the wheat crop by $10,575,000. The increase would be sufficient for the bread ration of 1,358,661 people. The DeKalb soils series constitute 40 per cent. of the land area of the State. Some types of these soils are today abandoned land because they are believed to be unprofitable, yet experiments conducted by the Experiment Station have proved that when treated with phosphate and lime, good crops can be produced. The Pennsylvania Experiment Station has forty fertilizer plots with ten complete four years rotations with records of each year's production. From the results of these experiments, definite recommendations can be made as to the treatment of the Hagerstown soils. These are definite illustrations of the value of carefully planned and conducted research and experimentation, as a factor in increasing the food supply of the State. The extremely interesting and valuable fertilizer plots, which have paid for their upkeep more than a thousand times over are applicable only to one kind of soil. They do not tell the effect of fertilizer treatment and rotation of different crops on the Westmoreland, the DeKalb, the Berks Shale, the Chester and the Penn soils. Similar experimentation on these soils would undoubtedly teach lessons, which, applied by the farmers, would result in increased yield per acre and cheaper production.

WORK OF THE EXPERIMENT STATION.

If the agriculture of the State is to advance so as to be profitable to those who live on the land, and so as to provide a larger quantity of the food at a reasonable cost for the workers in the industries, that the industries may be able to meet the competition of industries in other parts of the country, it will be essential to increase considerably the work of the Experiment Station. Especially is it important that a complete study be made of the soils of the State:

1. Soil survey by counties. This work is under way and up to the present time seventeen counties have been completed. It is important that the rest of the counties be surveyed at an early date.
2. A chemical study of the different types of soils as located by the soil survey and a laboratory study of their relative productiveness.
3. Fertilizer experiments with series of crop rotations on the principal soil types.
4. Variety test of staple crops, fruits and vegetables, to determine adaptation to localities.
5. Experiments in the improvement of pastures. There are approximately 3 million acres of permanent pasture lands in the State. The pastures in many instances are a limiting factor in the amount of livestock a farm can carry. The improvement of run-down pastures, without a prohibitive cost, is of great economic importance in the farming systems in many sections.

Information based upon careful research and experimentation on the above mentioned questions is necessary to increase intelligently the yield per acre of the different crops, and to make each section of the State produce the varieties of crops for which it is best adapted. It is a lack of this specific knowledge which, in a large measure, is responsible for the very low increase in yield per acre in Pennsylvania during the last forty years.

In addition to the fundamental studies as related to soils and crop selection, the question of the protection of the crops from the destruction by plant diseases and pest is of utmost importance. The annual loss to the State from animal diseases and plant pests is conservatively estimated at between eighty and ninety million dollars. The scientist through his research work in the laboratory and his field observations and field tests has worked out many successful methods of dealing with destructive pests. Yet there are numerous diseases of animals, and pests of the fruit, vegetable and general farm crops for which no successful means of combat has yet been found. There are problems in nutrition and in the breeding, feeding, management of horses, cattle, swine, and poultry—problems of great importance to the State in the economic converting of the hays, fodders, grains, into human food problems in the manufacture and storing of dairy products, fruits and vegetables, involving bacteriological and chemical research.

There are in the State 202,250 farms, varying in size from three to over a thousand acres. The great difference in size of farms, climate, location, and the great varieties of crops and livestock it is possible to grow in Pennsylvania, make innumerable combinations practicable, not only as to kind, but also as to relative amount of each crop, and the number of different kinds of livestock to have on a particular size farm in a definite location. Farm management surveys give a general idea as to combinations which are the most profitable under varying conditions, but they do not demonstrate the possibilities. The working out of farming systems, both from the point of demonstrating profit during the present period of agricultural development and from the point of demonstrating the possibilities for the future, needs the background of research and experiment.

It is true that the knowledge gained by research and experimental work alone, will not increase production and the farm income. To apply it requires additional capital at reasonable interest rates. It also requires grading and standardization of products, and improved business and marketing facilities. Nevertheless, it is essential to have the knowledge before it can be applied.

RESEARCH—THE FUTURE SAVING FACTOR.

A plea for developing research and experimental work at the Pennsylvania Experiment Station, is not a plea for special favors to the farmer. It is a plea for increased agricultural production, for commerce, and for industries. This country can boast of its large productions of agricultural and industrial products per man, a fact largely responsible for our commercial and industrial success, for it is the surplus production per family on the farm and in the factory that makes possible the flow of products from the farm to the city, and from the factories back to the farm. Alarm has often been expressed because of the decrease in the number of farmers and the increase in the city dwellers. This is not as serious as it may appear on the surface, as long as it is possible by increased production per man on the farm, to meet the added requirements of the city and give to those living on the land a reasonable remuneration for the services and capital invested.

In China, for example, approximately 70 per cent. of the population live on the land and 30 per cent. in the cities. Each family producing only a small surpus, if any, and there is very little exchange of product between the country and city, and instead of commerce, industry and prosperity, there is poverty, and frequent periods of starvation.

In the United States 32 per cent. of the people live on the farms and 68 per cent. in the city, yet by organized effort and the stimulus of price, the farms of this country during the war produced enough for the needs of the people in the city and enough more to save a large portion of the people in Europe from starvation.

The large production per man has been made possible primarily by the use of farm machinery and other labor saving devices on the farm, enabling one man to farm a larger area. The average size of the farms in Pennsylvania is 87 acres. Both the size of the farms and the character of land, in many instances, do not lend themselves to the use of farm machinery to the same degree and advantage as the farms in the Middle Western States. Therefore the increased production per man must come largely through an increased yield per acre.

There is but one road to increased economical yield per acre in Pennsylvania, and this leads through the research laboratory, the experimental plot and the experimental farm. Guess work must be eliminated. Guessing is too slow, too disappointing and too expensive.

If the State of Pennsylvania continues to neglect the development of research and experimental work in agriculture, the agricultural progress of the State will be retarded, many of the farms will decrease rather than increase in fertility, the surplus production per man will decrease, the exchange of products between the country and city will be decreased, the industries of the State will have to depend more and more upon food hauled long distances at added cost. There will be more, rather than less, abandoned farms in the less productive agricultural sections of the State, and we will face rural decadence rather than rural progress.

To many people familiar with the educational work in agriculture at the Pennsylvania State College, the splendid Extension Service rendered through the County Farm Bureaus, the work of the vocational schools and the work of the State Department of Agriculture, the above statement may seem exaggerated. However, it must be kept clearly in mind, that whatever success these organizations are having, in increasing production of crops and livestock products, is due to research and experimental work in science and agriculture. If the State Department of Agriculture is successful in decreasing losses from Hog Cholera, it is only because research in the laboratory has developed hog cholera serum. If the Extension Service is successful in increasing the yield of potatoes from 100, to 300 bushels per acre, it is because research work in the laboratory and in the field discovered a method to control insect and fungus diseases of the growing plant. If a boy or a girl on the farm, under the direction of a vocational teacher, raises a pig to reach maximum growth and development at maturity, it is because scientific work in nutrition and feeding had made known the proper combinations of feed to use.

Furthermore, whether or not the agriculture of Pennsylvania will advance, depends upon the ability of the agriculture of Pennsylvania to meet the competition of other States, which after all is the final test. Purely from a business standpoint, it is important to know the progress in research work in other States, especially those States with which Pennsylvania competes. New York State is a large competitor of Pennsylvania in potatoes, fruits and vegetables. For years money has been appropriated for the New York Agricultural Experiment Stations. For the fiscal year 1919-1920, $255,000 was appropriated. During the same year Ohio appropriated $279,000; West Virginia, $67,500; Maryland, $52,400; in 1920-1921, New Jersey, $114,000. Pennsylvania in 1921 appropriated $6,000 for the biennium to the Pennsylvania Experiment Station to be expended in tobacco experimentation in cooperation with the tobacco growers' organizations and the U. S. Department of Agriculture. Pennsylvania has never made a direct appropriation for the support of its Agricultural Experiment Station. The work carried on has been conducted from the small yearly appropriation from the Federal Government, and such small amounts of money as could occasionally be obtained from the maintenance appropriation of the college.

Many research and experimental problems important to the agriculture and to the industry of the State will require several years for solution, and without a definite financial policy by the State to the Experiment Station which will assure permanency to the work no definite progress can be made. The Agricultural Experiment Station will never meet the problems of the State until a specific appropriation is made for its support of research work.

Considering the great varieties of soil, the great varieties of crops, the splendid markets in the State and the changed agricultural conditions of the country, Pennsylvania has innumerable undeveloped agricultural possibilities. To realize these, opportunity is needed, not only for the development of the rural and vocational school, the teaching and extension work in agriculture and the new highway system, but a definite State plan and policy for research and experimental work in science and agriculture.